

A Project Report
ON
Cyber security threat analysis in E-learning

*Submitted in partial fulfillment of
the requirement for the award of the
degree of*

Bachelor Of Technology



(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

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CANDIDATE'S DECLARATION

I/We hereby certify that the work which is being presented in the thesis/project/dissertation, entitled **“CYBER SECURITY THREAT ANALYSIS IN E-LEARNING.”** in partial fulfillment of the requirements for the award of the **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING** submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of **JULY-2021 to DECEMBER-2021**, under the supervision of Dr. Kirti Shukla, Assistant Professor, Department of Computer Science and Engineering, Department of Computer Science and Engineering, Galgotias University, Greater Noida

The matter presented in the thesis/project/dissertation has not been submitted by me/us for the award of any other degree of this or any other places.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

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SAHIL SRIVASTAVA–18SCSE1010519 has been held on _____ and his/her work is recommended for the award of BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING.

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Signature of Dean

Date: December, 2021

Place: Greater Noida

ABSTRACT

The Covid-19 pandemic significantly affected the learning sector. E-learning was the main method to proceed with the instructive interaction, since March 2020. Various technologies including Cloud computing, different learning managements, video conferencing applications, etc, whose use was almost negligible became the most important part of the learning sector during the pandemic. Hence, the risk of DoS / DDoS attacks, cross-site scripting, spoofing, unauthorized data access, and infection with malicious programs, but also the theft of personal data has increased dramatically. This paper will be based on the different types of threats during e-learning and also suggest various ways to improve the technologies and protection from various threats. It may include updating systems, checking for malware, encryption decryption processes during file transfers over the network and so on. This paper will be based on security issues in different networking sites used for E-learning.

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CHAPTER-1

Introduction

As the use of modern technologies around the world increases, the need to ensure cyber security has increased even more over the past 20 years. But truly revolutionary, this need became a reality in 2020 with the COVID-19 pandemic. The current reality is that hyper-connected and complex, using multiple technologies, its impact on cyber security has not yet been assessed. Cyber security can be defined as protecting consumers from the dangers associated with the use of modern communication technologies. According to research by the Ponemon Institute[1], which conducts cybersecurity research, global data breaches in 2020 averaged \$ 3.86 million, with the health sector most affected (\$ 7.1 million) . The most affected country is the United States (\$ 8.64 million). The effect of remote work due to the COVID-19 pandemic increases the average cost of data breach as a result of remote work by \$ 137,000. Therefore, the average loss for a data breach is approximately \$ 4 million. Analyzing data from the same research, it can be estimated that the risks of data breach in the education sector was \$ 3.90 million in 2020. For example, approximately \$1.53M in 2020 was the data breach losses recorded during the pandemic.

Higher education institutions (HEIs) are increasingly affected by cyber-attacks, and the figures reported in 2020 are alarming. Cybercriminals are interested in stealing the personal data of students and staff, as well as controlling devices and resources, making access possible through the use of various technologies such as remote access and online learning platforms. The main purpose is not to gain access to a personal account, but to use personal credentials to try new phishing or spam attacks, but also for subsequent attempts to steal money. With the spring of 2020, as the offline study was halted due to the pandemic along with COVID-19, the education sector was further damaged, and the new reality had to be applied. Online study has become a major way to study in schools and universities. The sector is not prepared for such a challenge, as many problems arise, including: vulnerabilities that have not yet been studied or discovered, teachers who are not trained for online courses and students who do not have the necessary equipment (e.g. laptop) or a fast internet connection for video streaming media. Companies that protect property, staff and students do not have clear cyber security policies for online activities.

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In situations of COVID 19, when social distance becomes urgent, most of the activities at HEI must be done remotely, in accordance with legal regulations issued by health commissions around the world. Therefore, distance education has become the only opportunity to ensure the continuity of the educational process. A recent global survey conducted by Pearson Education, an academic publishing house, found that 90% of respondents believe that online education is important in the field, even after the end of the COVID-19 pandemic. In this situation it is necessary to remotely study and identify technologies that allow work, hazardous technologies and solutions to secure them.

2.1 Cloud Computing

Cloud computing (CC) [2] has many benefits for HEI, from storing data and conducting classes online, to changing university network infrastructure or using resources provided by the cloud. In the event of pandemic, the cloud has become a primary service for accessing resources and storing information in the educational environment. Furthermore, CC services directly contribute to ensuring the quality of education, only online study is possible. The use of virtual laboratories and simulated environments allowed the construction of skills that no longer depended on the physical presence of students in institutions. Adopting CC in higher education promotes better academic standards and student abilities [3]. Within HEI, CC services was widely implemented in 2020. Universities generally use the following cloud service model [4]:

1) Infrastructure as Service (IaaS) provides virtual infrastructure to run and run software, including applications and operating systems [5]. Information technology is especially important for students studying.

2) Platform as a Service (PaaS): This model of cloud services supports the development of applications through the programming languages, services and tools provided by cloud platform providers. For example, an instructor can create a virtual customized lab for students using PaaS [5].

3) Software As a Service (SaaS) allows educational institutions to use applications over the Internet through a cloud platform. The advantage of SaaS is that it eliminates licensing costs, installation and software management [5].

2.2 Learning Management Systems (LMSs)

LMS was implemented until the pandemic, but during this period they were completely exploited. Complex courses are created with a wide variety of activities such as seminars, lessons, dictionaries, practical assignments, assessment tests. According to the LMS Market Report [6], LMS leaders in European HEI are:

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Moodle (65%), Blackboard (12%), Elias (4%) and Sakai (3%). Data analysis provided by Google Trends, for the period 2019-2020, will increase interest in various LMS platforms in Europe and around the world. Moodle has also proven to be the most popular LMS.

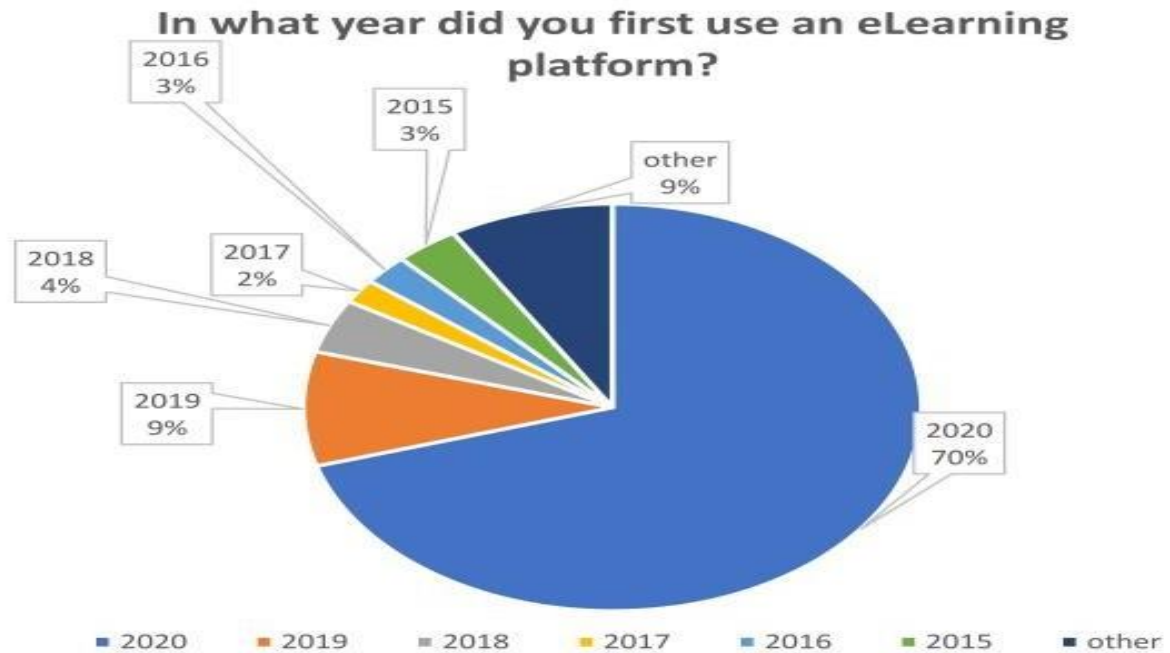


Fig 1. Use of E-learning Platform in different years

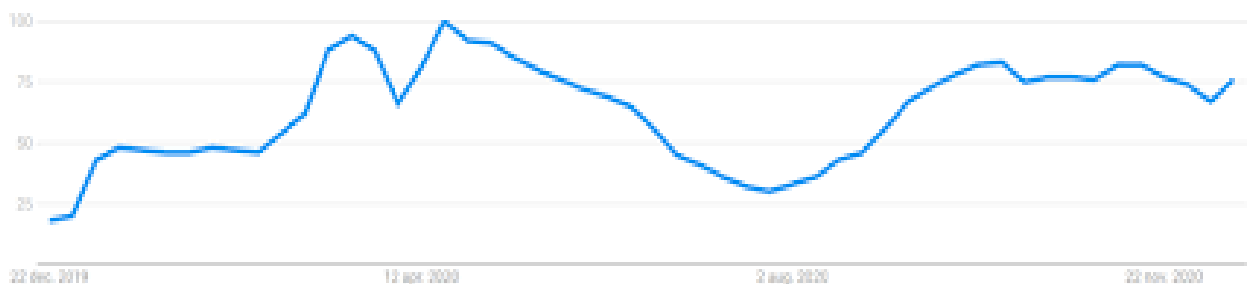


Fig.2 Global interest level for Moodle 2019-2020 (by Google Trend)

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2.3 Video conferencing applications (VCA)

VCA is the main source of communication in these situations. There are many applications in this regard like Zoom, GoToWebinar, Cisco WebX, Livestorm, ON24, Adobe Connect, Microsoft Teams. The application concept is the same, different methods are used. According to a report submitted by the company Datanyze, the world leader in technology, the first three VCAs to be used worldwide by 2020: Zoom, Gotowebinar and Cisco Webex. According to the report [7], video conferencing applications are leaders in Europe: Germany, Bulgaria, Italy, the Netherlands, Sweden and Switzerland.

Growth in Downloads of Video Conferencing Apps

During Week of March 15-21, 2020 vs. Weekly Average for Q4 2019 During COVID-19 Pandemic

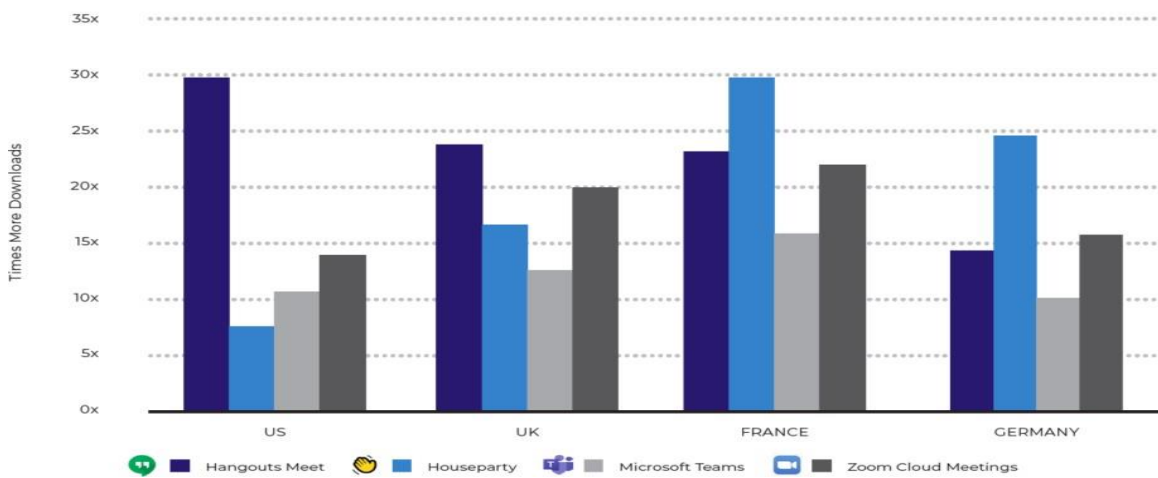


Fig.3 Growth of use of Video Conferencing App

Ranking	Technology	Domains	Market Share
1	Zoom	30583	36,15%
2	GoToWebinar	18486	21,85%
3	Cisco Webex	14628	17,29%

Fig.4 Use of VCs globally

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The research process involves reviewing various publications in top digital libraries such as IEEE Explore, ScienceDirect and SpringerLink, published between 2011 and 2020, but created by companies that specialize in cybersecurity solutions for different security years 2019-2020. A detailed analysis of the reports is also included. According to a report submitted by ENISA, threat analysis in HEI is a very important area of research [7] In 2020, the education sector is targeted by cyber intelligence campaigns due to interest in COVID-19 research results. Additional confirmation data reported by Kaspersky [3] suggest that 350% of DoS / DDoS attacks, targeted attacks on educational resources, are responsible for longer distance education services compared to 2019.

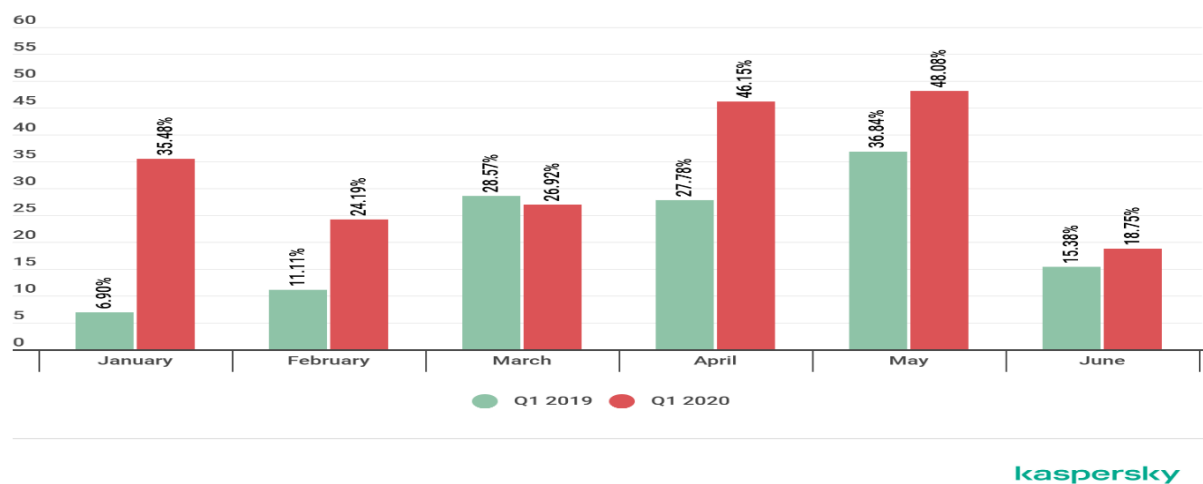


Fig.5 Percent of total number of DDoS attacks that affected educational resources

3.1 Security threats of CC services

The major security threats of CC can be classified into 5 categories [8], [9]:

1) Shared technology flaws - due to scalable infrastructure used by cloud service providers. All layers of shared technology are attacked to gain unauthorized access to data such as CPU, RAM, hypervisor, applications, etc. [10]. Where do other neighborhood virtual machines (VMs) live.

2) Data Infringement - User data may be subject to both accidental data loss and malicious intrusion. Such a form of attack occurs when a virtual machine uses a shared component such as a processor cache to access data from another virtual machine running on the same physical host.

3) Account or service traffic hijacking - a user may lose control over his own account. The effect of using one-step authentication, for example, is similar to that of password-based authentication.

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4) Denial of Service (DoS) - This is a common attack in cloud environments, which requires all CPU, RAM, disk space and network bandwidth to make the service inaccessible to attackers. The main disadvantage of cloud services in the case of DoS attack is that in the case of resource request, the cloud environment increases the number of allocated resources. This means that on the one hand the cloud system resists the effects of the attack, but on the other hand it supports his malicious activities, giving him more resources [11].

5) Harmful insiders - Employees of the company providing cloud services may be members and employees. They can access sensitive information that is not traditionally available.

3.2 Security threats of LMS Platforms

Before analyzing the risks of online learning platforms, it is necessary to explain the basic principles for ensuring the quality of online courses. This aspect is explained in the light of three principles of information security: privacy, integrity and availability. The most important security vulnerabilities discussed in the literature are classified into four groups: authentication, availability, confidentiality, and integrity attacks.

- Authentication - broken authentication and session management; Insecure communication.
- Availability - Denial of service.
- Confidentiality attacks - insecure cryptographic storage; Unsecured live object reference, information leakage and improper error management.
- Integrity Attack - Buffer Overflow, Cross-site request forgery, Cross-site scripting, Failed to restrict URL access, Injection error, Malicious file execution.

3.2 Security threats of VCAs

A really impressive increase in use during the epidemic with COVID-19 was the application to teleconferencing, because many activities and events were planned offline, due to new operating conditions, migrating to the online environment. Thus, in December 2019, the Zoom application registered 10M daily users, while in March 2020, Zoom registered 200M daily users. When it comes to video conferencing, cyber security, which begins with the theft of personal data such as email, is very important, as is the data that users connect to and the end that is transmitted, or the security of end-user devices and that control. Therefore, the key elements of Convention Security can be divided into three main areas:

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1. Pre-call policies Setting up settings and access rules for the application before the conference starts (e.g. via email).
2. As data is transferred using private and public networks, data transmission procedures are very important for securing video conferencing. This may include access after the conference has started or notifying the user when they see the conference or unauthorized re-broadcasting of the conference.
3. Post-call procedures are about storing various metadata, namely: shared presentations, video and audio recordings. Analyze the threats identified in 2019-2020 among the most used VCAs worldwide. Some threat reported are:
 - Decrypt video and audio calls on company servers that are not always in the seller's home country. Although applications are reported to use end-to-end (E2E) encryption, it is only used to encrypt correspondence and documents. For a zoom application that uses a combination of TCP and UDP, TCP connections are encrypted using the TLS protocol and UDP connections are encrypted with AES using the key discussed via the TLS connection. This type of encryption is called transport encryption when the HTTPS protocol is used, not E2E.
 - Control Windows and MacOS workstations, webcams and microphones or distribute obscene content.
 - Extracting details from a physical location. Hacking can analyze and study the environment rather than an e-mail or computer hacking video application. Users need to ensure the security of their physical location.

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The following figure 6 shows an overview of the proposed P2P audio and video calling application functions. This proposed system provides direct real-time connection with remote peers without any servers. To start the connection, users must go through the signaling server to locate and locate the remote peer. Once the session is established, a two-way direct connection can be activated without having to go through the signaling server.

Trending features in video conferencing

- Video conferencing is constantly evolving worldwide with the advancement of technology with bigger screens, high quality cameras and high speed internet connections. Here are 10 trending features that will change the way we expect video conferencing tools to grow and improve in the future:
- **Browser based video conferencing solution**
WebTRC is a free open source technology that enables one-click video calling from a web browser without the need for any downloads or plug-in installation. Sangma Meet is a great example of this new technology. With one click, you can schedule a call from your web browser, join a meeting, or enable instant video conferencing.
- **Integrated communication solutions**
Companies that want to thrive in this new environment need to implement a complete solution for a unified communication experience for their internal and external customers. Basic services that address issues such as "voice only", "chat only" or "video conferencing only" can help businesses solve problems with bigger easy collaboration and their employees' high efficiency, collaboration under a single app, internal and external. It is important to have all services for communication. This means that the message, voice and video are all in one place.
- **Video conferencing room**
Similar to 1: 1 meetings, room-based video conferencing is designed for whole room meetings. Participants and online guests joined in the meeting room and could easily communicate with the help of large screens, smart noise-canceling speakers, sensitive microphones and wide angle or rotating cameras. These have enabled us to collaborate smoothly with people around the world. New high-tech hardware is available every day to improve communication. Providers offering bundle packages of hardware and software may soon dominate the market, providing a one-stop-shop experience for IT departments looking for a unified communication service to sign contracts.

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- **Everything is carried in the cloud**
Everything is moved to the cloud and video conferencing is no exception. Whether you are scheduling a call with your coworkers or inviting a customer for a demo, you can use a video conferencing solution hosted in the cloud without any investment in hardware or software infrastructure. Huh. Since all of this is done automatically in the cloud you can subscribe to Cloud Solution and take advantage of the latest technologies without having to worry about upgrading or upgrading your infrastructure and someone else (the provider) will do it for you. Taking care of everything.
- **SSO (Single Sign-On)**
With the rise of all-in-one UC solutions, businesses are looking to facilitate access to these systems by connecting them to the company's single sign-on system, allowing employees to access them with the same credentials they already know. So, whether you log into your software application to make phone calls, sign in to your messaging tools, or access your contact list to initiate a video call, all your tools work easily and on the same basis for fast access. Many companies have already implemented SSO for certain tools, such as email and ticketing systems. SSO becomes an important feature for many companies to adopt communication tools.
- **Deep integration with other communication solutions (voice, video, SMS)**
Imagine your desk phone ringing, you are not at your desk, but you can select a call-up in your software app on your mobile phone, transfer it to video conference, invite your coworkers to call, and then invite clients and finally to collaborate and file projects and file and file. Everything can be made a seamless experience if the tools are deeply integrated.
- **High quality video and audio**
No matter how great a video conferencing tool is, if video and audio quality do not meet certain standards, users will fall and this will quickly reduce the conversion rate of video conferencing tools. Therefore, high-quality video interaction should be the ultimate goal for all providers and businesses that adopt the new video conferencing solution.
- **Smart content search**
With the proliferation of collaborative tools and instant-messaging tools on video conferencing platforms, tagging content and searchable keywords will soon become an essential feature of any video conferencing solution.
- **AI. Effect of**
Amazon's "Alexa," Apple's Siri and other smart assistants are already changing our way of life. There are many applications of AI that make meetings easier and

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more enjoyable for us. AI can create custom backgrounds for participants, assist in editing gazes, or transliterate messages in real time for each guest in the conference. Meeting assistants can schedule calls on our behalf and remind us of future meetings and this is usually just the beginning of AI's impact on communication. How nice is it to use your face as a passport to log in to meetings by identity?

- **Natural Language Processing (NLP)**
NLP plays a role in improving the video conferencing user experience. Connected with AI you can use voice activation to start or end the meeting or ask people to mute when they are not talking. We hope to see real-time translation in video conferencing soon in the future as well.

The proposed system should be used by two students in one session. Students can use their own workstation or any other device as long as HTML5-enabled browser and browser-supported WebRTC. Two processes are required before two students can begin to communicate with each other. First, the caller call session must be set up and a unique token created for the specific URL call session. Second, the caller will share the URL with his friend, paste the URL link in the browser and the call session will be set up.



Fig 6. Overview of proposed system

We are developing it on Visual Studio Code. But to build real time audio video capabilities we are using agora.

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Visual Studio Code –

Visual Studio Code is a lightweight yet powerful source code editor that runs on your desktop and is available for Windows, macOS and Linux. It comes with built-in support for JavaScript, TypeScript and Node.js and comes with a rich ecology of extensions for other languages (such as C ++, C #, Java, Python, PHP, Go) and runtime (such as .NET and Unity).

Visual Studio Code combines the simplicity of a source code editor with powerful developer tools such as IntelliSense code completion and debugging. First of all, this is an editor that gets out of your way. A fun conflict-free edit-build-debug cycle means spending less time with your environment and more time implementing your ideas. At its core, Visual Studio Code includes a lightning fast source code editor, perfect for everyday use. With support for hundreds of languages, VS Code can help you become instantly productive with syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets and more. Intuitive keyboard shortcuts, easy customization and community-provided keyboard shortcut mapping to help you easily navigate your code. For extreme coding, you often benefit from a tool that has more code comprehension than a block of text.

Visual Studio Code includes IntelliSense code complement, rich semantic code understanding and built-in support for navigation and code refactoring. And when coding is difficult, debugging also happens. Debugging is often a feature that developers often miss in the lean coding experience, so we did so. Visual Studio Code includes an interactive debugger that allows you to step through source code, check variables, view call stacks, and execute commands on the console. VS also integrates with code build and scripting tools to perform simple tasks that speed up daily workflows. VS code has git support so you can work with root control without leaving the editor, including viewing pending changes.

Customize each feature to your liking and install any number of third-party extensions. While most scenes work "out of the box" without any configuration, the VS code also grows with you and we encourage you to customize your experience to suit your specific needs. VS Code is an open source project, so you can also contribute to the growing and powerful community on GitHub. VS code has great built-in support for Node.JS development with JavaScript and TypeScript, powered by the same built-in technologies that run Visual Studio. VS Code also includes excellent tools for web technologies such as JSX / React, HTML, CSS, SCSS, LESS and JSON.

Structurally, Visual Studio Code combines the best web, local and language-specific technologies. Using Electron, VS Code combines web technologies such as JavaScript and Node.js with the speed and convenience of native apps. VS code "Monaco" uses a newer, faster version of the same industrial-powered HTML-based editor that powers

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the cloud editor, F12 tools of Internet Explorer, and other projects. Additionally, VS Code uses tool service architecture to integrate with many technologies that power visual media, including Roslin, for .NET, typewriting, visual studio debugging engine and more. Some are included. Visual Studio Code includes the Public Extensibility model, which allows developers to create and use extensions and greatly customize their edit-build-debug experience.

In VS Code Editor, after setup, we are using HTML, CSS, Javascript for frontEnd Development.

HTML –

HTML stands for Hypertext Markup Language. It is used to create web pages using markup language. HTML is a combination of hypertext and markup language. Hypertext defines the link between web pages. Markup language is used to define the text document in the tags that define the structure of web pages. This language is used to quote text (making notes to the computer) so that a machine can understand it and change the text accordingly. Most markup languages (such as HTML) are human readable. Uses language tags to define which text to change.

HTML is the markup language used by browsers to convert text, images and other content so that it is displayed in the required format. HTML was created by Tim Berners-Lee in 1991. The first version of HTML was HTML 1.0, but the first standard version was HTML 2.0, published in 1999. Most HTML tags have a tag name, tag attributes, a closing tag with a forward slash and an opening tag with a closing tag. Name. For tags that do not have an end tag like , it is best to end the tag with a forward slash. Most tags are less or more than angle brackets and everything between open and closed tags is displayed or affected by the tag.

It looks like this-

```
<!DOCTYPE HTML>
<html>
  <head>
    <title>Example page</title>
    <meta http-equiv="Content-Type" content="text/html; charset=windows-1252">
  </head>
  <body>
    <h1>This is a heading</h1>
    <p>This is an <b>example</b> of a basic HTML page.</p>
  </body>
</html>
```

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- The DOCTYPE line describes in which version of the HTML the page is written so that the Internet browser can understand the following text.
- The <html> opening tag tells the browser that the HTML code is being read.
- The <head> section contains information about the page, such as its title, meta tags, and where to find the CSS file.
- The <body> section contains everything that can be viewed in the browser. For example, the entire text that appears here is in the body tag.
- The <h1> tag is the visible title of the page.
- The <p> tag is a paragraph of text. Most web pages (like these) contain multiple paragraph tags.
- The paragraph has a tag, which makes the word paragraph bold in the paragraph.
- Finally, the closing tags wrap around each of the tags mentioned above.

HTML5 is an update from HTML4 to HTML (XHTML follows a different version numbering scheme). It uses the same basic rules as HTML4, but adds some new tags and features that allow better semantics and dynamic elements to be activated using JavaScript. New elements include: <article>, <aside>, <audio>, <bdi>, <canvas>, <datalist>, <detail>, <embed>, <shape>, <fig>, <footer>, <header>, <keygen>, <icon>, <m>, <nav>, <output>, <progress>, <rp>, <rt>, <ruby>, <time>, <track>, <video>, And <wbr>. There are also new input types for forms, including tel, search, url, e-mail, date time, date, month, week, time, date-local, number, range and color.

With the growing movement to keep structure and style apart, some styling elements were removed. Also tags that have accessibility issues or tags that are less usable are removed. The following elements are no longer used in HTML code: <acronym>, <applet>, <basefont>, <big>, <center>, <dir>, , <frame>, <frameset>, <noframes>, <Strike > And <tt>. HTML5 also simplifies the doctype declaration for tags in the box below.

CSS-

Cascading style sheets are affectionately known as CSS, a simple design language intended to facilitate the process of displaying web pages. CSS maintains the look and feel of a web page. Using CSS, you can control the color of the text, font style, spacing between paragraphs, column size and layout, what background images or colors are used, layout design, different devices and screen sizes. Can control variation in performance. As well as many other effects. CSS is easy to learn and understand but provides powerful control over HTML document presentation. Typically, CSS is combined with markup languages such as HTML or XHTML.

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Benefits of CSS

- CSS saves time - you can write CSS once and reuse a single sheet on multiple HTML pages. You can define a style for each HTML element and apply it to as many web pages as you want.
- Pages load faster - if you use CSS, you do not have to write HTML tag attributes every time. Write the css rule of the tag and apply to all events of that tag. So less code means faster download times.
- Easy maintenance - make global changes, change the style and all elements on all web pages will be updated automatically.
- Better Styles Than HTML - CSS has more advanced features than HTML, so you can give your HTML page a better look than HTML features.
- Multiple Device Compatibility - Style sheets allow you to optimize content for more than one type of device. Using the same HTML document, different versions of the Website can be provided for PDAs and handheld devices such as cell phones or printing.
- Global Web Standards - HTML attributes are now disabled and it is recommended to use CSS. So it's a good idea to start using CSS on all HTML pages, making them compatible with future browsers.

CSS is created and maintained in the W3C by a group of people called the CSS Working Group. Creates a document called the CSS Working Group Specification. When a specification is discussed and formally approved by W3C members, it is recommended. These approved specifications are called recommendations because the W3C has no control over the actual implementation of the language. Independent companies and organizations make that software. The World Wide Web Consortium, or W3C, is a group that makes recommendations on how the Internet works and how it should be developed.

Cascading Style Sheets Level 1 (CSS1) came from the W3C in December 1996 as a recommendation. This version describes the CSS language as well as a simple visual formatting model for all HTML tags. CSS2 became a W3C recommendation in May 1998 and is based on CSS1. This version adds support for media-specific style sheets e.g. Printers and aural devices, downloadable fonts, element positioning and tables.

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JAVASCRIPT-

JavaScript is a dynamic computer programming language. It is lightweight and is commonly used as part of web pages, the implementation of which allows client-side scripts to interact with the user and create dynamic pages. It is a programming language described with object-oriented capabilities. JavaScript was formerly known as LiveScript, but Netscape changed its name to JavaScript, probably due to the excitement created by Java. JavaScript first appeared on Netscape 2.0 in 1995 under the name LiveScript. The general-purpose core of the language is embedded in Netscape, Internet Explorer and other web browsers.

The ECMA-262 specification core defines the standard version of the JavaScript language.

- JavaScript is a simple, applied programming language.
- Designed to create network-centric applications.
- Complemented and integrated with Java.
- Supplements and integrate with HTML
- Open and cross-platform

Client side JavaScript-

Client-side JavaScript is the most common form of language. The script for the browser must be included or specified in the HTML document in order to understand the code. This means that the web page does not have to be static HTML, but contains programs that interact with the user, control the browser, and dynamically create HTML content. The JavaScript client-side mechanism offers many advantages over traditional CGI server-side scripts. For example, you can use JavaScript to check if a user has entered a valid e-mail address in the Form field.

The javascript code is executed when the user submits the form and if all entries are valid, they are submitted to the web server. JavaScript is used to directly or indirectly trap user-initiated events, such as button clicks, link navigation, and other user-initiated actions.

Advantages of JavaScript

Benefits of using JavaScript -

- Less Server Interaction - You can verify user input before sending the page to the server. This saves server traffic, which means less load on your server.
- Instant feedback to visitors - they do not have to wait for the page to reload to see if they forgot to register anything.

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- Improved Interactivity - You can create interfaces that respond when the user holds them with the mouse or activates them with the keyboard.
- Rich Interface - You can use JavaScript to add objects such as drag and drop components and sliders to provide a rich interface to your site visitors.

JavaScript limitations

We cannot consider JavaScript as a complete programming language. It lacks the following important features -

Cannot read or write JavaScript files on client side. It was kept for security reasons.

JavaScript cannot be used for networking applications as such support is not available.

JavaScript has no multi-threading or multiprocessor capabilities.

Once again, JavaScript is a simple, applied programming language that allows you to build interactivity on static HTML pages.

JavaScript development tools

One of the major strengths of JavaScript is that it does not require expensive development tools. You can start with a simple text editor like Notepad. Since it is a language applied in the context of a web browser, you do not even need to purchase a compiler.

To make our lives easier, various vendors have come up with great JavaScript editing tools. Here are some of them -

- Microsoft Frontpage - Developed a popular HTML editor called Microsoft FrontPage. FrontPage also provides a number of JavaScript tools to assist web developers in creating interactive web sites.
- Macromedia Dreamweaver MX - Macromedia Dreamweaver MX is the most popular HTML and JavaScript editor in the professional web development crowd. It offers very easy pre-built JavaScript components, integrates well with databases and meets new standards such as XHTML and XML.
- Macromedia HomeSite5 - Homesite5 is a popular HTML and JavaScript editor from Macromedia that is used to effectively manage personal websites.

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Where is JavaScript today?

The ECMAScript version 5 standard is the first update to be released in four years. JavaScript 2.0 is compatible with version 5 of the ECMAScript standard and the differences between the two are minimal. Today, Netscape's JavaScript and Microsoft's JScript conform to the ECMAScript standard, although both languages still support features that are not part of the standard.

JavaScript applications:

- **Web Development: Adding Interactivity and Behavior to Static Sites** Javascript was invented in 1995 to do this. This can be achieved very easily by using AngularJS.
- **Web Applications:** With technology, browsers have evolved to the point where language is needed to create robust web applications. When we browse the map in Google Maps, all we have to do is click and drag the mouse. All detailed views are just a click away and this is only possible due to JavaScript. It uses application programming interfaces (APIs) that provide additional power to the code. Electron and reaction are useful in this section.
- **Server Applications:** With the help of Node.js, JavaScript leads from client to server and Node.js is the most powerful server side.
- **Games:** Not only on websites, Javascript also helps in creating games for leisure. The combination of JavaScript and HTML5 makes Javascript also popular in game development. It provides an EaseJS library that offers solutions for working with rich graphics.
- **Smartwatch:** JavaScript is being used on all possible devices and applications. It provides the PebbleJS library used in smartwatch applications. This framework works for applications that require the Internet to work.
- **Art:** Artists and designers can create whatever they want using JavaScript to draw on HTML5 canvas, and also use the p5.js library to make the sound more effective.
- **Machine Learning:** This JavaScript ml5.js library can be used in web development using machine learning.

CHAPTER 3 RESEARCH METHODOLOGY

We are using real time engagement for audio and video calls is Agora.

Agora-

Agora Real-Time Messaging (RTM) SDK provides you with a streamlined and consistent messaging mechanism to quickly implement real-time messaging for a variety of scenes. To make real-time engagement ubiquitous, it allows everyone to interact with anyone, anytime, anywhere.

Agora is a popular video, voice and live interactive streaming platform that helps developers deliver great experiences in the app, including embedded voice and video chat, real time recording, interactive live streaming and real time messaging. Traditionally, real-time video and voice have taken place in standalone, dedicated applications, but people are looking to connect directly to the applications they are already using. These real-time voice and video solutions are difficult and expensive to develop, requiring reliable multi-way transmission of large amounts of data across geographies and network operators, often resulting in data packet loss and slow response times. In 2013, our founder anticipated this future and set out to design a solution.

Today Agora is a real-time engagement platform for developers, providing developers with an easy, customizable, and widely customizable API for embedding real-time video and voice in their applications without the need to build infrastructure. Real-time data transmission is managed through our software-defined real-time network (SD-RTN™), which has more than 200 presence worldwide. Using advanced algorithms, SD-RTN™ constantly monitors and optimizes data transmission paths, reducing latency and packet loss when enabling high-quality real-time connectivity across millions of simultaneous users. The goal is to empower every developer - whether as a sole proprietor or as part of a larger organization - to create innovative products, enhance customer experiences, differentiate themselves and develop future applications. To influence real-time engagement to build.

Agora Platform Advantage

- Agora's real-time engagement platform offers universal coverage with ultra-low latency, scalability and flexible interactive features. Easy to embed APIs, comprehensive SDKs and partner ecosystems help you embed voice, video, real-time messaging and recording solutions quickly and inexpensively.
- SD-RTN
Agora's software-defined real-time network is the most widely used and intelligent RTE network in the world.

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- **World coverage**
Agora's SD-RTN offers a wide range of worldwide coverage. With over 200 data centers worldwide, you can connect people anywhere.
- **Very short delay**
Provide high-quality, consistent transmission to your customers. Agora's algorithms monitor the network in real time and automatically select the most efficient routing path, providing a minimum delay of 400 ms or less.
- **Scalability**
When your user base suddenly grows, Agora backs you up. In most cases, you can scale up or down on the fly. For dramatic growth, our team will work closely with you and plan to expand smoothly.
- **Reliability**
Agora Platform is available 99.99% of the time. Because Agora has created redundant servers and data centers, your customers can interact with your app 24 hours a day, every day of the year.
- **Efficiency**
Agora transmits data efficiently, thus saving you and your customers money without compromising on quality.
- **High quality mobile phone**
The Agora platform is optimized to provide high quality, consistent voice and video streams to mobile phones worldwide, despite the common challenge of relying on cell towers despite packet loss and signal degradation.

Made for developers

It makes it easy to get started with the Agora platform and incorporate voice chat, video chat and live interactive video streaming into your applications.

- **Rapid integration**
Agora's powerful, feature-rich API reduces the amount of code you have to write and helps you to market your app faster, reduce development costs and increase return on investment (ROI).
- **Developer favorable price**
Your first 10,000 minutes a month are upon us! After that, Agora will charge the same price in all global areas, so you can expand internationally without a complicated budget.

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- **Compatibility with third party features**
Agora supports a variety of third-party add-ons to add extra functionality and flexibility to your apps.

- **Companion ecosystem**
Agora partners with development agencies and systems integrators around the world to provide solutions to all your needs.

Agora provides the foundation for your global application.

- **SDK for wide access**
Agora connects people anywhere, anytime, on any device. To fulfill that promise, we provide SDKs for all major mobile, web, desktop and gaming platforms. No matter what platform you develop on, we will protect you.

- **Regional support**
To increase the convenience and data privacy of your business, you can take advantage of Agora's network areas by specifying the areas where your data flows

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If company is very likeable, its team members can be deployed in different locations, serve customers in different locations or work remotely in a comfortable work environment. Many teams are new to working remotely due to the COVID-19 pandemic, which has made a mistake in terms of care and security and allows employees to work from home until they return safely to the office.

Now, many team members in companies and industries are turning to video meeting apps to manage video meetings, such as weekly team meetings or board meetings. Be able to make decisions. Most people are new to video conferencing and all generations have a learning curve as they become more comfortable with video apps like Zoom, Microsoft Teams and more.

Remote work can be of great benefit to the organization, as remote workers may feel isolated, which ultimately affects their productivity. Video conferencing is one of the most useful tools to increase the productivity of remote workers. When personal communication is not an option, video conferencing is preferred for connecting with coworkers. There are many applications and platforms for video conferencing and collaboration. Some industry standards like Cisco WebEx but expensive. Others are popular and can be offered for free or even at a lower price. Here is a list of the top 10 video chat apps for your hybrid teams to start productive online meetings at no cost. Each of these software options works well with Meeting Owl Pro and helps hybrid teams connect more.

These video meeting apps are trusted teleconferencing platforms that are ideal for organizations of any size. For teams that are changing their remote working lifestyle due to COVID-19, these user-friendly apps allow you to connect with your peers without any hassle. Each of these platforms offers free video conferencing and a variety of tools and integrations to ensure that your remote teams get the most out of their video chats.

1. Zoom

Zoom is one of the most popular video conferencing solutions for businesses. It is feature-rich with different plans depending on the size and needs of the business. Prices from their free plan for individual and group meetings to large companies up to \$ 19.99 / month / host (with at least 100 hosts). Millions of zoom users worldwide are happily using the free plan, but if you've been looking for something else for your remote teams, the enterprise-level plan includes 200 meeting participants, unlimited cloud storage, custom email, and vanity meeting URLs. More.

2. Skype for Business

Microsoft's popular Skype service has been touted as an enterprise-ready video conferencing tool. It has many business features such as allowing a maximum of

CHAPTER 4 EXISTING WORK

250 people to attend meetings, connections with other Skype users and virtual whiteboarding capabilities.

Despite some limitations such as the lack of an integrated dial-in audio conference feature and the lack of hardware support with online-only plans. The free version of Skype is a great tool for groups of less than 10 members and an easy way to make free conference calls from your computer, phone or tablet.

3. Slack

The most popular collaborative tool used by companies around the world, Slack integrates video conferencing features. If your company does not use Slack, it may not make sense to adopt it for video conferencing. But, if you are already using Slack, this is an easy way to make quick calls.

Video conferencing is a great tool for integrating add-ons and hybrid teams into Slack's functionality. Video chat with one another is part of Slack's free account offers and you can Slack with up to 15 people if you enable calls from the channel, but for larger meetings, a customized enterprise price is required. Requires a customizable quote.

4. Bigbluebutton

Open Source BigBlueButton is a whiteboard capable of meeting productivity and is designed specifically for education and online learning. As a free open source tool, there are numerous add-ons and integrations through third-party developers that allow for customized web conferencing experiences, including integration with the Learning Management Systems (LMS) that provide a seamless student and teacher experience. .

• Some free features of BigBlueButton:

- Audio and video screen sharing
- Record session option for playback
- Breakout room
- Cooperative tools such as whiteboard, shared notes and voting.

5. Blue jeans

BlueJeans is a full-featured web conferencing app that integrates with collaborative tools. Using a simple and sophisticated approach, unlike some of the more complex services offered by competitors, BlueGeans uses a system of conferences, rooms and events to launch video conferences anywhere.

6. Cisco WebX

Cisco's WebEx video conferencing service works as a mash-up of web conferencing and voice calling services online, especially for industry-standard service, large numbers of team members or exceptionally large individuals. Allows you to attend meetings by call, depending on the position and ability of

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the participants at that time. Prices start at \$ 13.50 / host / month.

7. Google Meet

Google Meet is a Google conference call software designed for enterprise customers. This is an improved version of Google Hangouts designed for teams. With features like zoom, calendar sync, conference room booking and a more enhanced user interface, Google Meet is designed for scheduled video conferencing between team members.

8. Blackboard collaborate

Blackboard Support is a video conferencing app of choice for teachers. With mobile accessibility, this tool helps teachers to connect with students on a laptop, tablet or smartphone. Classroom licenses start at \$ 300 per year, \$ 9,000 / year for departments, universities, schools and colleges and institutions.

9. Go to the meeting

GoToMeeting starts at \$ 14 / month for groups of 10 meeting participants and \$ 29 / month for large groups of up to 150 participants. This teleconference tool is well worth the cost as it has the following features:

- Screen sharing on desktop, tablet or smartphone
- HD video conferencing
- Smart Meeting Assistant that allows you to record meetings and generate automated transcriptions
- Hardware Bundle Kit with User Friendly Video Conferencing Software
- A business message that can be converted from a chat box to a video call with the click of a button

10. WhereBy

This video chat service is ideal for small companies that want an easy way to connect with team members. It provides fast service due to its streamlined nature. This (formerly Appear.in) app does not require download or login, users can simply share their meeting link and join anyone's browser. It starts for free, but teams pay \$ 59.99 per month, which allows multiple users and administrators.

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Video conferencing system that gives administrators the ability to remove Customers and also see the rooms. It gives the user two options after registration, Room Create or Join.

Create a room, creating a unique room key that the user can use or write on their own

The own key system checks whether its uniqueness and permission will be shown to the user later to allow the system to use the camera and microphone, the user can either allow or reject.

The Join Room option asks the user to enter the room key and if there is room

All system functions (chat, record, share desktop and share file) appear

Joiner users with a special feature (presence) found only in the room

Creator.

4.1 System Functionality

The system divides users into two roles according to their rights:

1. Administrator: Administrator means a person who can see and remove attendee and rooms.
2. User: The user is the person who created or joined the session.

4.1.1 System Administrator and User Functions

There is only one function between admin and user login

An operation that allows the system administrator or user to log in to a web page

Entering username and password.

4.1.2 System Administrator Functions

There are many functions like admin: add users or rooms, view

Delete users or rooms and attendee and rooms.

An administrator can add user, add room, view user, view room, delete user, delete room, record meeting, share file, chat etc.

4.1.3 System user functions

There are many tasks such as system user: sign up, create room or

Join rooms, make voice or video calls, chat, share files or make desktop and voice or video Record.

It will allow user to join room, view room, view other attendees, record, chat, share file etc.

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4.2 System Nonfunctional Requirement

The system has many non-functional requirements such as portability and security

And availability.

- **Portability**
Users can access the system from anywhere with any operating system.
- **Security**
WebRTC Security has a major advantage over most VoIP services area. Until now, most services have considered security as an option, as WebRTC bans unencrypted communication, users can relax so that their data is secure and private. This encourages WebRTC developers to take their security seriously. The main premise for having encryption by default is that calls are private. As always. Security and encryption are no longer considered optional Properties.
- **Availability**
The service should be available to all customers at any time.

4.3 Use Case Diagram

The videoconference system consists of three actors: Admins, Room Creators and Room joiner.

Admin can perform many operations: add, view and delete two rooms

Creator and Room Joiner Create or join the Room, a special operation of the Room Creator to see attendance.

All functions in the system require login, you must be registered to login Accounts. All these activities are described in fig.7

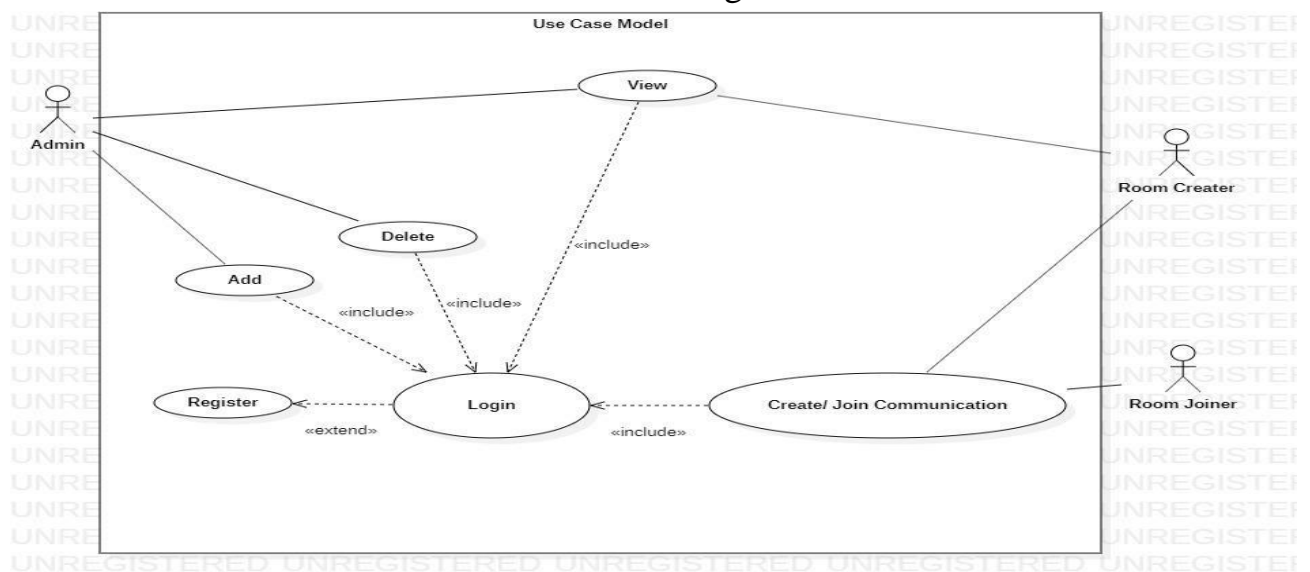


Fig.7 Use Case Diagram

CHAPTER 5

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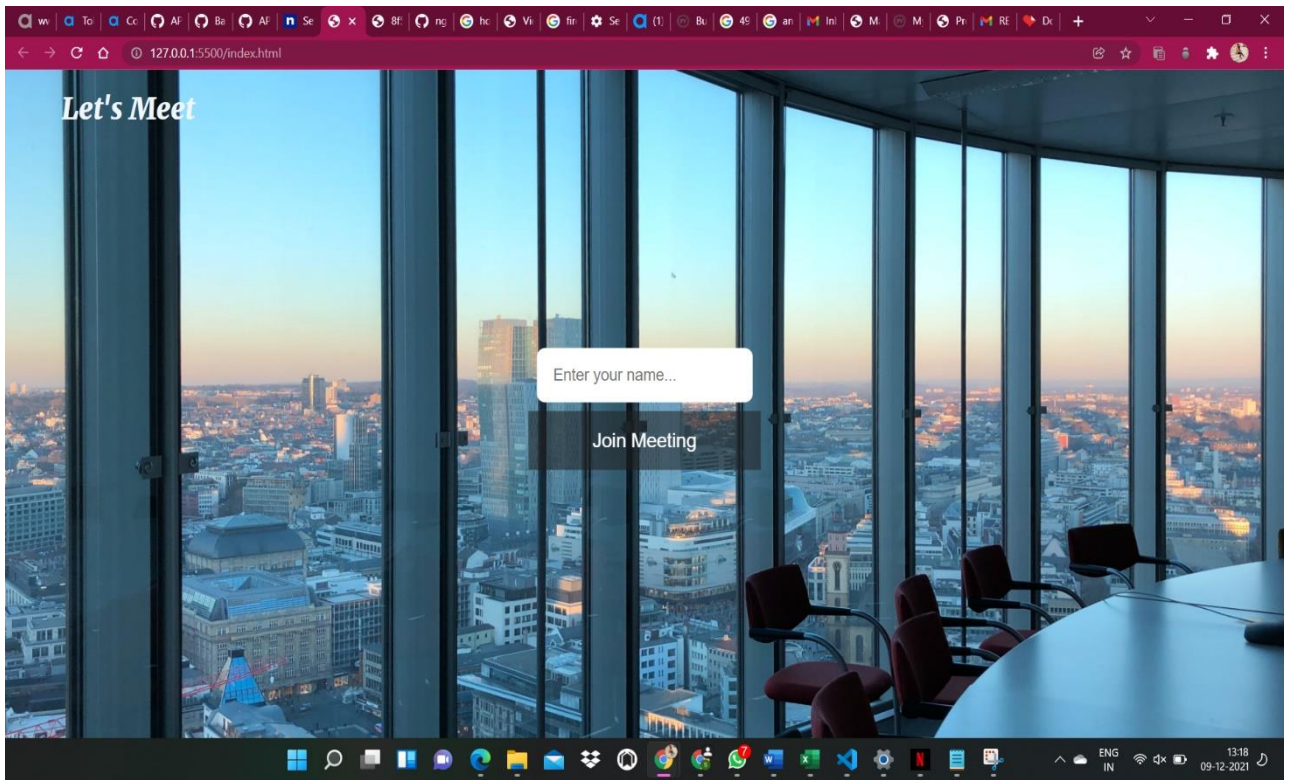


Fig 8. Home Screen of Let's Meet

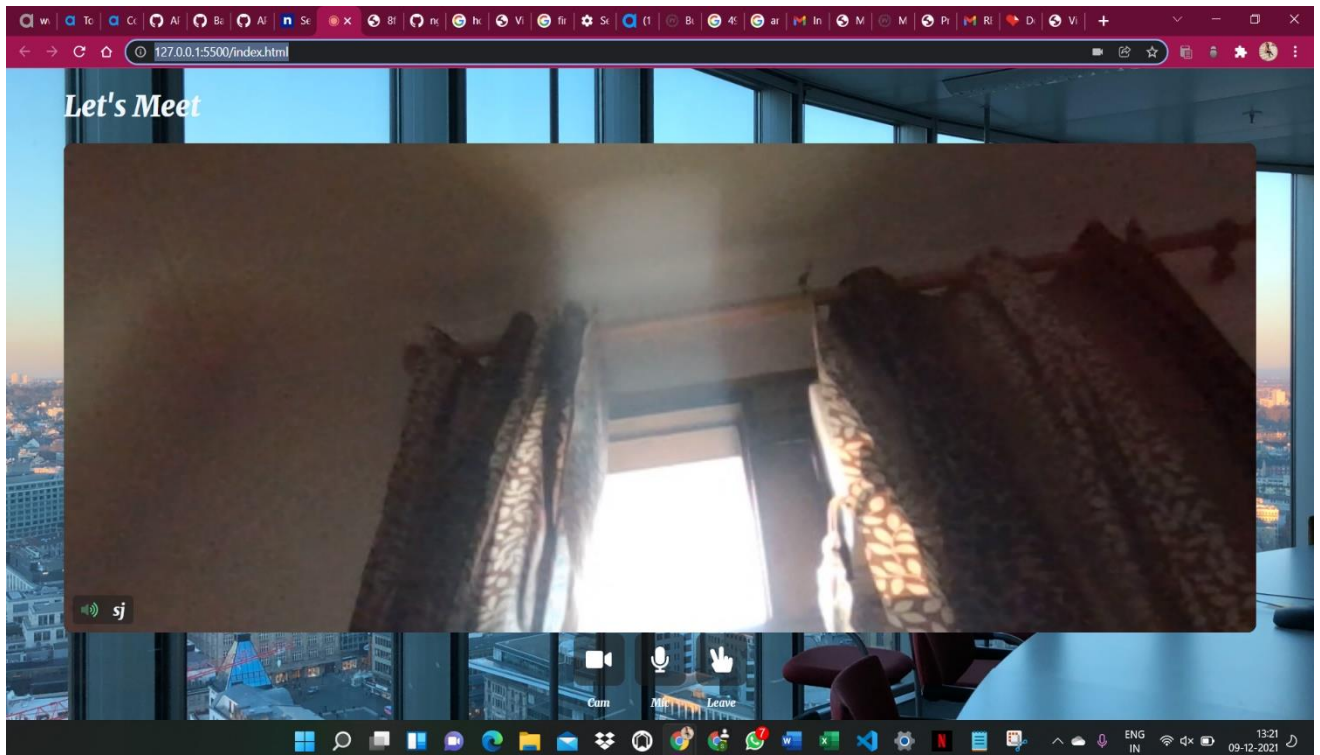


Fig 9. Single User Joined on Let's Meet

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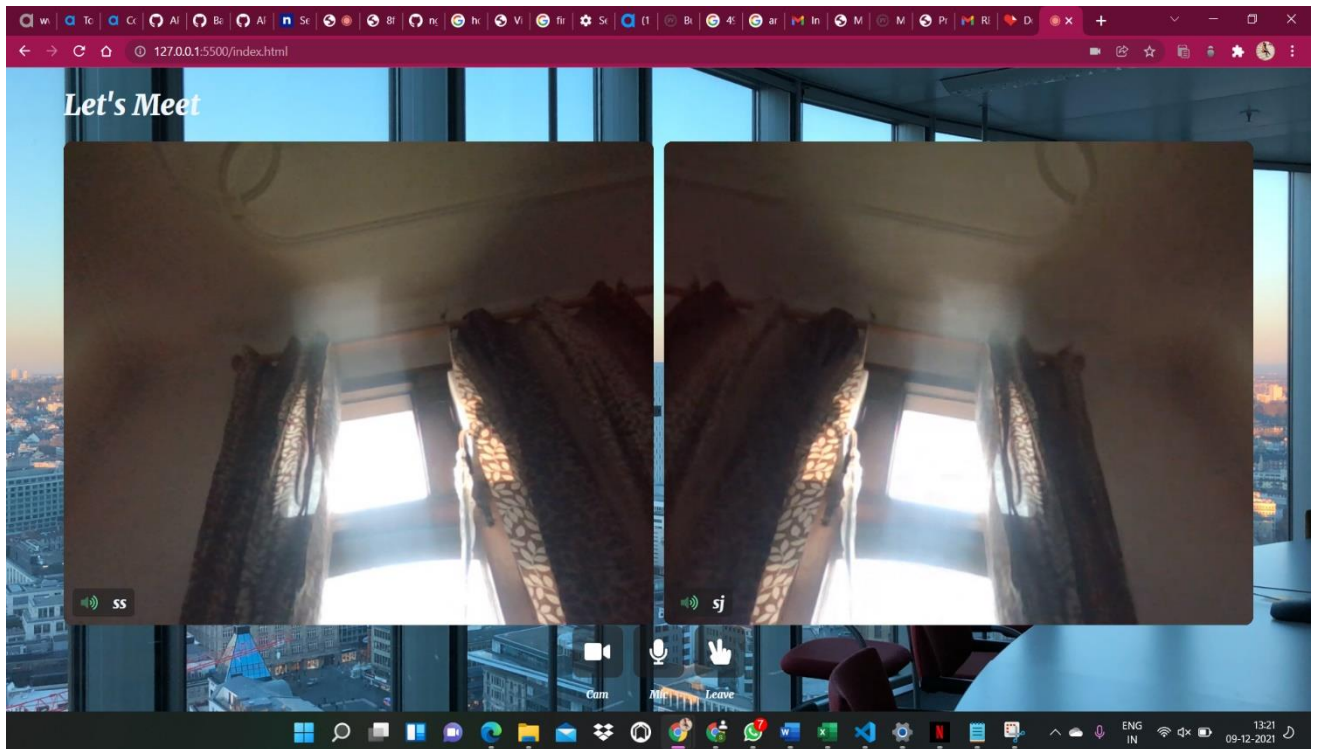


Fig 10. Multiple User joined on Let's Meet

HTML CODE-

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Video-Chat</title>
  <link rel="stylesheet" href="main.css">
  <link rel="preconnect" href="https://fonts.googleapis.com">
  <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
  <link
href="https://fonts.googleapis.com/css2?family=Merriweather:ital,wght@1,900&displa
y=swap" rel="stylesheet">
</head>
<body>
```

CHAPTER 5

PROJECT DESIGN AND DIAGRAM

```
<main>

  <!-- <div id="users-list"></div> -->

  <h1 id="site-title">Let's Meet</h1>
  <div id="join-wrapper">
    <input id="username" type="text" placeholder="Enter your name..." />
    <button id="join-btn">Join Meeting</button>
  </div>
  <div id="user-streams" ></div>

  <!-- Wrapper for join button -->
  <div id="footer">
    <div class="icon-wrapper">
      
      <p>Cam</p>
    </div>

    <div class="icon-wrapper">
      
      <p>Mic</p>
    </div>

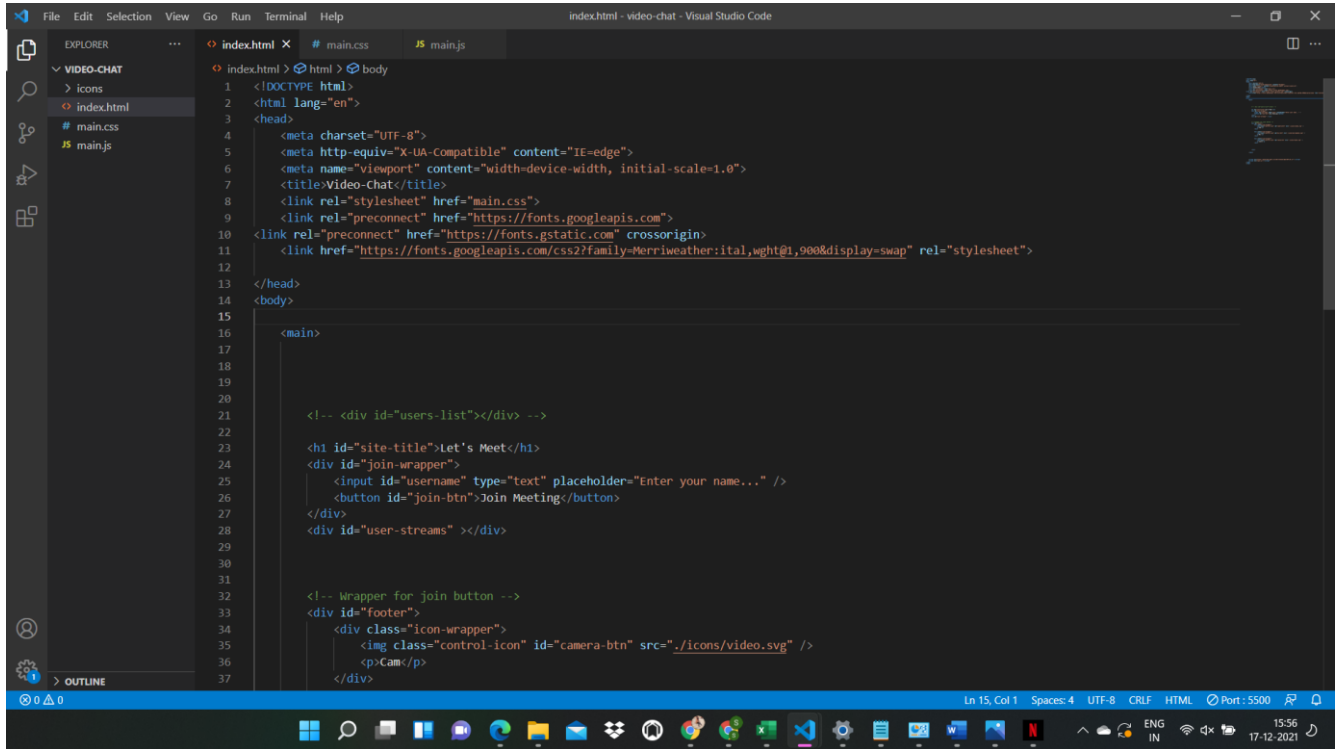
    <div class="icon-wrapper">
      
      <p>Leave</p>
    </div>
  </div>

</main>

<script src="https://download.agora.io/sdk/release/AgoraRTC_N.js"></script>
<script src='main.js'></script>
</body>
</html>
```

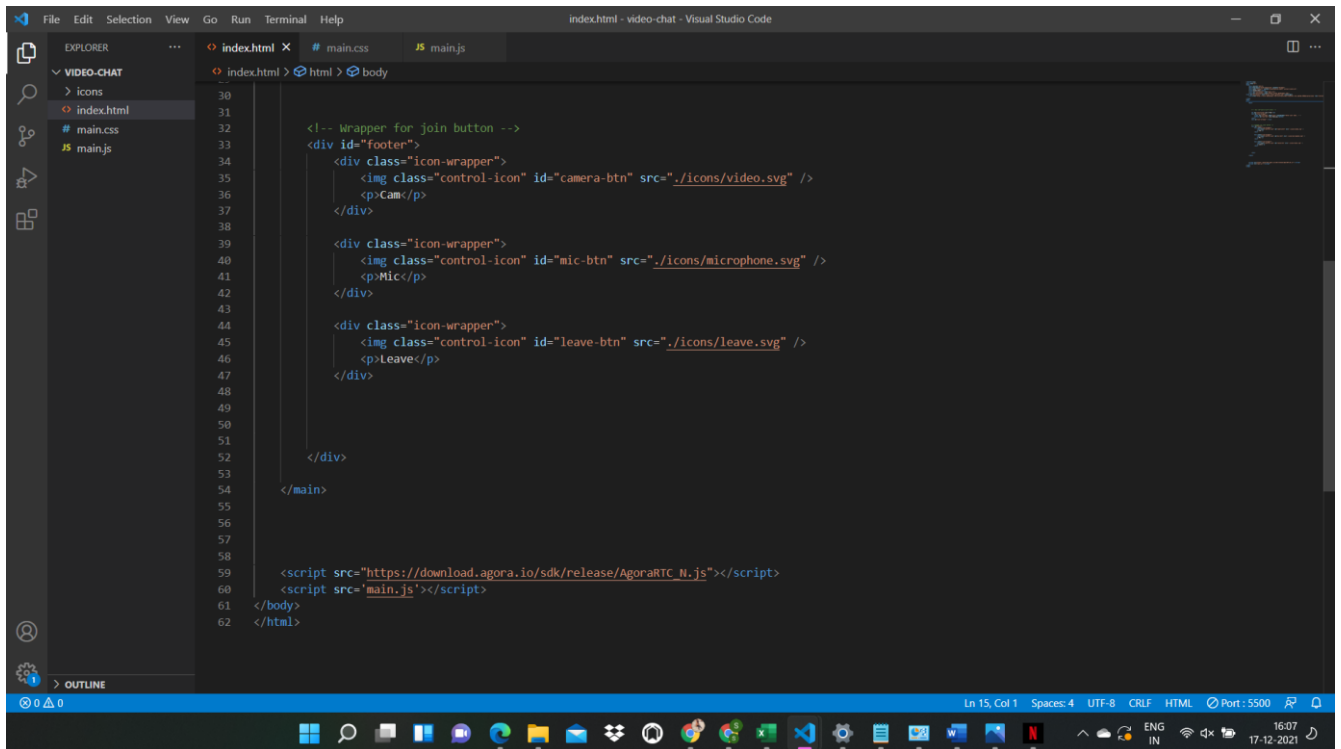
CHAPTER 5

PROJECT DESIGN AND DIAGRAM



```
index.html - video-chat - Visual Studio Code
EXPLORER
VIDEO-CHAT
  icons
  index.html
  main.css
  main.js
index.html X # main.css JS main.js
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4   <meta charset="UTF-8">
5   <meta http-equiv="X-UA-Compatible" content="IE=edge">
6   <meta name="viewport" content="width=device-width, initial-scale=1.0">
7   <title>Video-Chat</title>
8   <link rel="stylesheet" href="main.css">
9   <link rel="preconnect" href="https://fonts.googleapis.com">
10  <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
11  <link href="https://fonts.googleapis.com/css2?family=Merriweather:ital,wght@1,900&display=swap" rel="stylesheet">
12
13 </head>
14 <body>
15
16   <main>
17
18     <!-- <div id="users-list"></div -->
19
20
21     <h1 id="site-title">Let's Meet</h1>
22     <div id="join-wrapper">
23       <input id="username" type="text" placeholder="Enter your name..." />
24       <button id="join-btn">Join Meeting</button>
25     </div>
26     <div id="user-streams" ></div>
27
28     <!-- Wrapper for join button -->
29     <div id="Footer">
30       <div class="icon-wrapper">
31         
32         <p>Cam</p>
33       </div>
34
35       <div class="icon-wrapper">
36         
37         <p>Mic</p>
38       </div>
39
40       <div class="icon-wrapper">
41         
42         <p>Leave</p>
43       </div>
44     </div>
45
46   </main>
47
48   <script src="https://download.agora.io/sdk/release/AgoraRTC_N.js"></script>
49   <script src="main.js"></script>
50 </body>
51 </html>
```

Fig. 11 HTML Code Execution



```
index.html - video-chat - Visual Studio Code
EXPLORER
VIDEO-CHAT
  icons
  index.html
  main.css
  main.js
index.html X # main.css JS main.js
30
31
32   <!-- Wrapper for join button -->
33   <div id="Footer">
34     <div class="icon-wrapper">
35       
36       <p>Cam</p>
37     </div>
38
39     <div class="icon-wrapper">
40       
41       <p>Mic</p>
42     </div>
43
44     <div class="icon-wrapper">
45       
46       <p>Leave</p>
47     </div>
48   </div>
49
50 </main>
51
52   <script src="https://download.agora.io/sdk/release/AgoraRTC_N.js"></script>
53   <script src="main.js"></script>
54 </body>
55 </html>
```

Fig. 12 HTML Code Execution

CHAPTER 5

PROJECT DESIGN AND DIAGRAM

CSS CODE-

```
body {
  margin: 0;
  padding: 0;
  background-image: url("../icons/meeting.jpg");
  background-repeat: no-repeat, repeat;
  background-position: center;
  background-attachment: fixed;
  background-size: cover;
  color: aliceblue;
  font-family: 'Merriweather', sans-serif;
}
```

```
main {
  width: 1400px;
  margin: 0 auto;
  height: 75vh;
}
```

```
#site-title {
  font-family: 'Merriweather';
  font-size: 33px;
}
```

```
#join-wrapper{
  display: flex;
  flex-direction: column;
  position: fixed;
  left: 50%;
  top: 50%;
  transform: translate(-50%, -50%);
}
```

```
#username{
  padding: 20px;
  font-size: 18px;
```

CHAPTER 5

PROJECT DESIGN AND DIAGRAM

```
border-radius: 10px;
border:none;
margin: 10px;
}
```

```
.volume-icon{
height:20px;
width:20px;
}
```

```
#join-btn {

background-color: #1f1f1f8e;
border: none;
color: #fff;
font-size: 22px;
padding: 20px 30px;
cursor: pointer;
}
```

```
#user-streams {
display: grid;
grid-template-columns: repeat(auto-fit, minmax(600px, 1fr));
gap: 1em;
height: 100%;
}
```

```
.video-player {
width: 100%;
height: 100%;
border-radius: 10px;
overflow: hidden;
}
```

```
.video-containers {
position: relative;
padding: 0;
margin: 0;
background-color: #1f1f1f8e;
border-radius: 10px;
```

CHAPTER 5

PROJECT DESIGN AND DIAGRAM

```
}
```

```
.user-uid {  
  display: flex;  
  align-items: center;  
  column-gap: 1em;  
  background-color: #1f1f1f8e;  
  padding: 5px 10px;  
  border-radius: 5px;  
  position: absolute;  
  bottom: 10px;  
  left: 10px;  
  z-index: 9999;  
  margin: 0;  
  font-size: 18px;  
}
```

```
#footer {  
  position: absolute;  
  bottom: 0;  
  left: 0;  
  display: none;  
  justify-content: center;  
  column-gap: 1em;  
  width: 100%;  
  height: 100px;  
}
```

```
.icon-wrapper {  
  justify-content: center;  
  text-align: center;  
  cursor: pointer;  
}
```

```
.control-icon {  
  display: block;  
  padding: 15px;  
  background-color: #1f1f1f8e;  
  height: 30px;  
  width: 30px;  
  border-radius: 10px;  
}
```

CHAPTER 5

PROJECT DESIGN AND DIAGRAM

```
@media screen and (max-width:1400px) {  
  main {  
    width: 90%;  
    margin: 0 auto;  
  }  
}
```

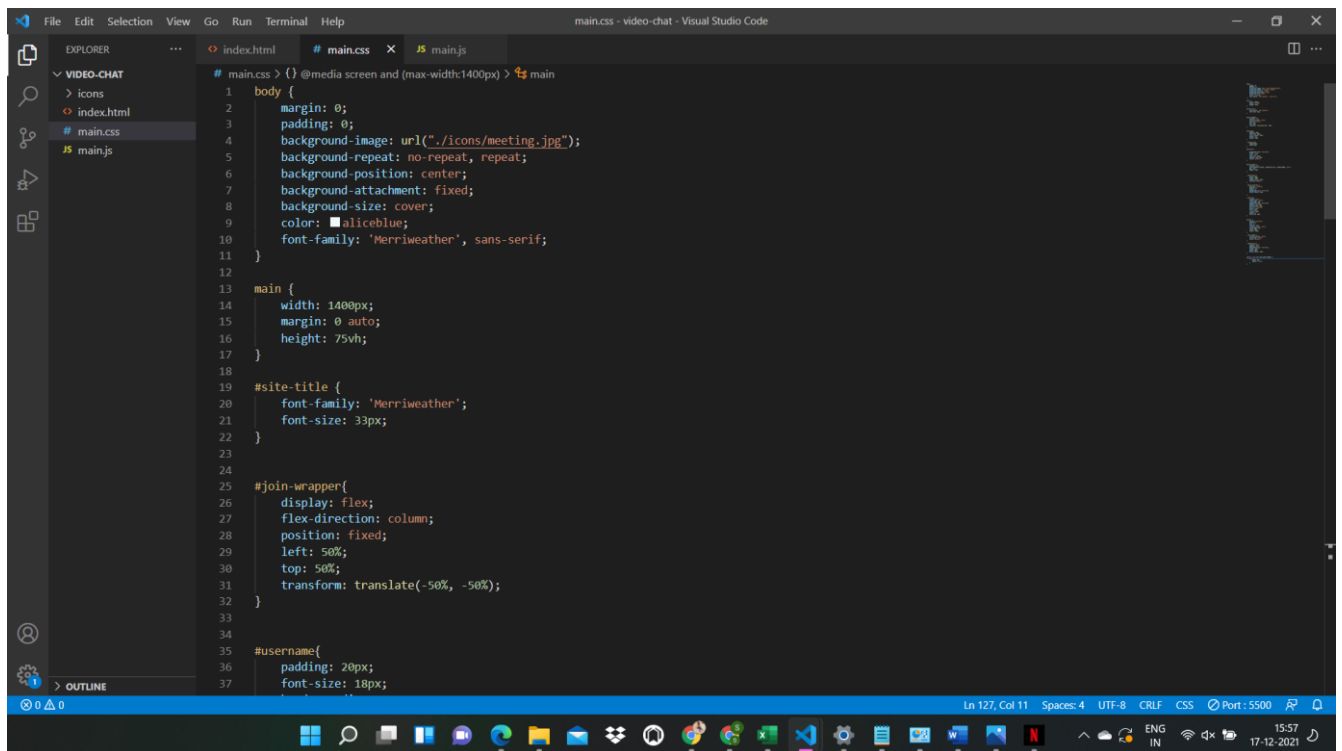


Fig 13. CSS Code Execution

JAVASCRIPT CODE-

//1st step

```
let client = AgoraRTC.createClient({mode:'rtc', codec:"vp8"})
```

//2nd step

```
let config = {
```

```
  appid: 'a93a3e10872341a7be3557df4a30b2f9',
```

```
  token:
```

```
'006a93a3e10872341a7be3557df4a30b2f9IACbIYpex1pxAEtO/P4+6g/4/RNPrTJIAkcT
```


CHAPTER 5

PROJECT DESIGN AND DIAGRAM

```
TPjbqWZkTFQub9IAAAAAEAA+DPg7YLuxYQEAAQBdu7Fh',
  uid:null,
  channel: 'videochat',
}
```

```
///  
//#3 - Setting tracks for when user joins  
let localTracks = {  
  audioTrack:null,  
  videoTrack:null  
}
```

```
///  
//#4 - Want to hold state for users audio and video so user can mute and hide  
let localTrackState = {  
  audioTrackMuted:false,  
  videoTrackMuted:false  
}
```

```
///  
//#5 - Set remote tracks to store other users  
let remoteTracks = { }
```

```
document.getElementById('join-btn').addEventListener('click', async () => {  
  config.uid = document.getElementById('username').value  
  await joinStreams()  
  document.getElementById('join-wrapper').style.display = 'none'  
  document.getElementById('footer').style.display = 'flex'  
})
```

```
document.getElementById('mic-btn').addEventListener('click', async () => {  
  //Check if what the state of muted currently is  
  //Disable button  
  if(!localTrackState.audioTrackMuted){  
    //Mute your audio  
    await localTracks.audioTrack.setMuted(true);  
    localTrackState.audioTrackMuted = true  
    document.getElementById('mic-btn').style.backgroundColor = 'rgb(255, 80, 80, 0.7)'  
  }else{  
    await localTracks.audioTrack.setMuted(false)  
    localTrackState.audioTrackMuted = false  
    document.getElementById('mic-btn').style.backgroundColor = '#1f1f1f8e'  
  }  
})
```

CHAPTER 5 PROJECT DESIGN AND DIAGRAM

```
document.getElementById('camera-btn').addEventListener('click', async () => {
  //Check if what the state of muted currently is
  //Disable button
  if(!localTrackState.videoTrackMuted){
    //Mute your audio
    await localTracks.videoTrack.setMuted(true);
    localTrackState.videoTrackMuted = true
    document.getElementById('camera-btn').style.backgroundColor = 'rgb(255, 80, 80,
0.7)';
  }else{
    await localTracks.videoTrack.setMuted(false)
    localTrackState.videoTrackMuted = false
    document.getElementById('camera-btn').style.backgroundColor = '#1f1f1f8e'
  }
})
```

```
document.getElementById('leave-btn').addEventListener('click', async () => {
  //Loop throu local tracks and stop them so unpublish event gets triggered, then set to
undefined
  //Hide footer
  for (trackName in localTracks){
    let track = localTracks[trackName]
    if(track){
      track.stop()
      track.close()
      localTracks[trackName] = null
    }
  }
}
```

```
//Leave the channel
await client.leave()
document.getElementById('footer').style.display = 'none'
document.getElementById('user-streams').innerHTML = ""
document.getElementById('join-wrapper').style.display = 'block'

})
```

```
//Method will take all my info and set user stream in frame
let joinStreams = async () => {
  //Is this place hear strategicly or can I add to end of method?

  client.on("user-published", handleUserJoined);
```

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PROJECT DESIGN AND DIAGRAM

```
client.on("user-left", handleUserLeft);
client.enableAudioVolumeIndicator(); // Triggers the "volume-indicator" callback
event every two seconds.
client.on("volume-indicator", function(evt){
  for (let i = 0; evt.length > i; i++){
    let speaker = evt[i].uid
    let volume = evt[i].level
    if(volume > 0){
      document.getElementById(`volume-${speaker}`).src = './icons/volume-
on.svg'
    }else{
      document.getElementById(`volume-${speaker}`).src = './icons/volume-
off.svg'
    }
  }
});
```

##6 - Set and get back tracks for local user

```
[config.uid, localTracks.audioTrack, localTracks.videoTrack] = await Promise.all([
  client.join(config.appid, config.channel, config.token ||null, config.uid ||null),
  AgoraRTC.createMicrophoneAudioTrack(),
  AgoraRTC.createCameraVideoTrack()
])
```

##7 - Create player and add it to player list

```
let player = `

```
document.getElementById('user-streams').insertAdjacentHTML('beforeend', player);
```



##8 - Player user stream in div



```
localTracks.videoTrack.play(`stream-${config.uid}`)
```


```

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```
//#9 Add user to user list of names/ids
```

```
//#10 - Publish my local video tracks to entire channel so everyone can see it  
await client.publish([localTracks.audioTrack, localTracks.videoTrack])
```

```
}
```

```
let handleUserJoined = async (user, mediaType) => {  
  console.log('Handle user joined')
```

```
//#11 - Add user to list of remote users  
remoteTracks[user.uid] = user
```

```
//#12 Subscribe ro remote users  
await client.subscribe(user, mediaType)
```

```
if (mediaType === 'video'){  
  let player = document.getElementById(`video-wrapper-${user.uid}`)  
  console.log('player:', player)  
  if (player !== null){  
    player.remove()  
  }  
}
```

```
  player = `    <p class="user-uid"> ${user.uid}</p>  
    <div class="video-player player" id="stream-${user.uid}"></div>  
  </div>`  
  document.getElementById('user-streams').insertAdjacentHTML('beforeend',  
player);  
  user.videoTrack.play(`stream-${user.uid}`)
```

```
}
```

```
if (mediaType === 'audio') {  
  user.audioTrack.play();  
}
```

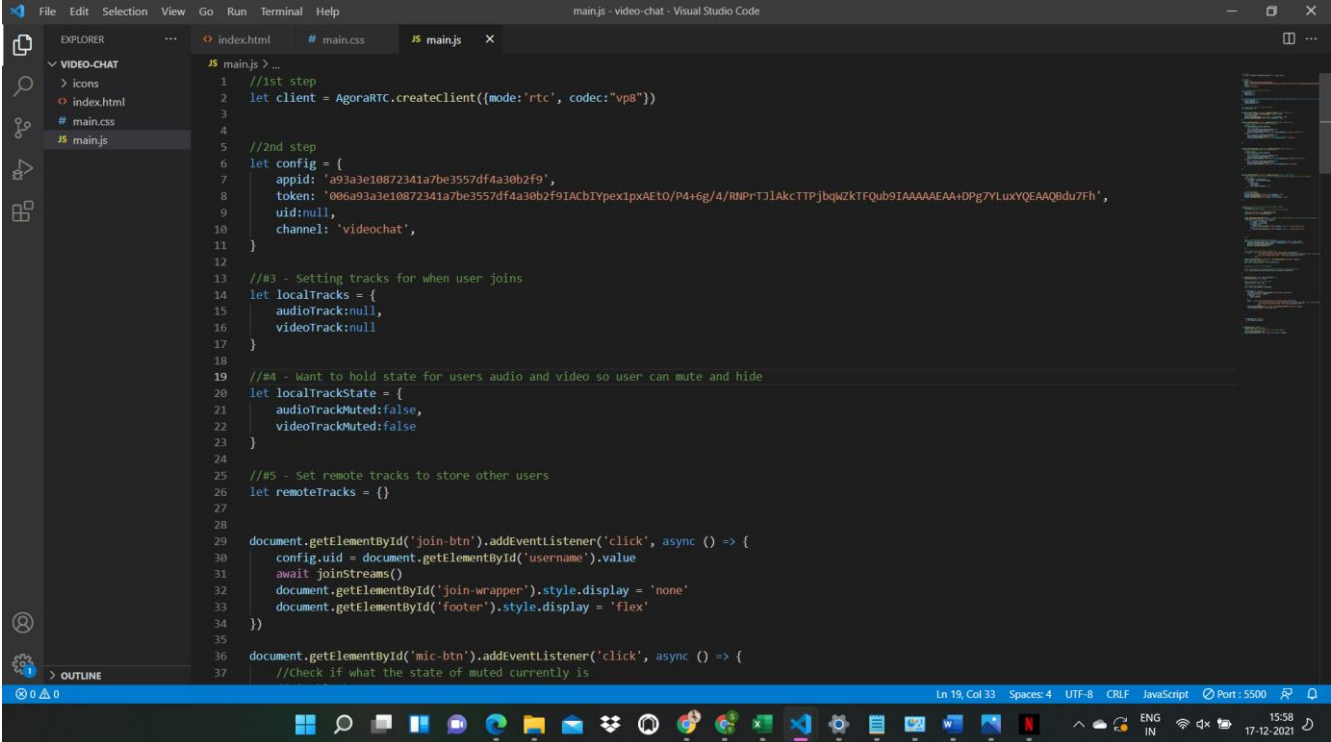
```
}
```

```
let handleUserLeft = (user) => {
```

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```
console.log('Handle user left!')
//Remove from remote users and remove users video wrapper
delete remoteTracks[user.uid]
document.getElementById(`video-wrapper-${user.uid}`).remove()
}
```



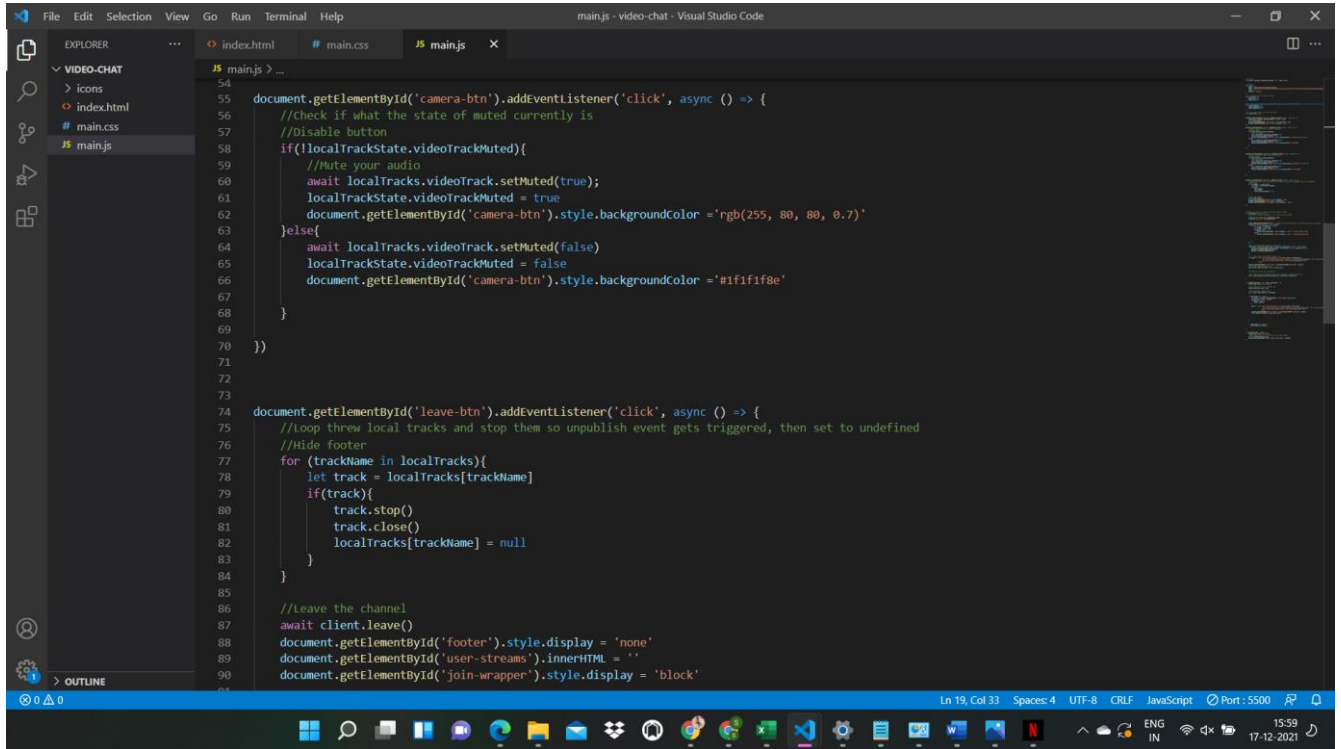
The image shows a screenshot of the Visual Studio Code editor interface. The main editor window displays a JavaScript file named 'main.js' with the following code:

```
1 //1st step
2 let client = AgoraRTC.createClient({mode:'rtc', codec:'vp8'})
3
4
5 //2nd step
6 let config = {
7   appid: 'a93a3e10872341a7be3557df4a30b2f9',
8   token: '006a93a3e10872341a7be3557df4a30b2f9IACbIVpex1pxAET0/P4+6g/4/RNPrTlAkctTPjbpqZKTFQub9IAAAAAEAA+DPg7YLuxYQEAAQ8du7Fh',
9   uid:null,
10  channel: 'videochat',
11 }
12
13 //#3 - Setting tracks for when user joins
14 let localTracks = {
15   audioTrack:null,
16   videoTrack:null
17 }
18
19 //#4 - Want to hold state for users audio and video so user can mute and hide
20 let localTrackState = {
21   audioTrackMuted:false,
22   videoTrackMuted:false
23 }
24
25 //#5 - Set remote tracks to store other users
26 let remoteTracks = {}
27
28
29 document.getElementById('join-btn').addEventListener('click', async () => {
30   config.uid = document.getElementById('username').value
31   await joinStreams()
32   document.getElementById('join-wrapper').style.display = 'none'
33   document.getElementById('footer').style.display = 'flex'
34 })
35
36 document.getElementById('mic-btn').addEventListener('click', async () => {
37   //Check if what the state of muted currently is
```

Fig. 14 Javascript Code Execution

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PROJECT DESIGN AND DIAGRAM



The image shows a screenshot of the Visual Studio Code editor interface. The main editor window displays JavaScript code for a video chat application. The code is organized into two main event listener functions. The first function, attached to a 'camera-btn', checks the current state of the video track. If it is not muted, it mutes the track and changes the button's background color to a dark gray. If it is already muted, it unmutes the track and changes the background color to a light gray. The second function, attached to a 'leave-btn', iterates through all local tracks, stopping and closing each one, and then sets the track to null. Finally, it calls 'client.leave()' to exit the channel, hides the footer, and shows the 'user-streams' area.

```
54
55 document.getElementById('camera-btn').addEventListener('click', async () => {
56   //Check if what the state of muted currently is
57   //Disable button
58   if(!localTrackState.videoTrackMuted){
59     //Mute your audio
60     await localTracks.videoTrack.setMuted(true);
61     localTrackState.videoTrackMuted = true
62     document.getElementById('camera-btn').style.backgroundColor = 'rgb(255, 80, 80, 0.7)'
63   }else{
64     await localTracks.videoTrack.setMuted(false)
65     localTrackState.videoTrackMuted = false
66     document.getElementById('camera-btn').style.backgroundColor = '#1f1f1e'
67   }
68 }
69
70 })
71
72
73
74 document.getElementById('leave-btn').addEventListener('click', async () => {
75   //Loop threw local tracks and stop them so unpublish event gets triggered, then set to undefined
76   //Hide footer
77   for (trackName in localTracks){
78     let track = localTracks[trackName]
79     if(track){
80       track.stop()
81       track.close()
82       localTracks[trackName] = null
83     }
84   }
85
86   //Leave the channel
87   await client.leave()
88   document.getElementById('footer').style.display = 'none'
89   document.getElementById('user-streams').innerHTML = ''
90   document.getElementById('join-wrapper').style.display = 'block'
91 }
```

Fig. 15 Javascript Code Execution

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Due to COVID-19 companies have suddenly become accustomed to working remotely at night, with many rushing to obtain video conferencing solutions, but ease of use, user-friendliness and a completely comprehensive experience (chat, video, voice) have been overlooked. It affects the performance of employees in the long run. Soon, many people will switch their video conferencing solution to another option.

As a result of the epidemic with COVID-19, the educational climate crossed a critical stage in 2020. Ensuring cyber security in remote activity remains an ongoing challenge. Identifying the specific nature of remote operations and threats in security assets and HEIs, and addressing security is an important step in ensuring cyber security. In addition, financial losses in education have increased this year as a result of online activities. Transferring locally stored data to the cloud poses new challenges in the field of information security, but it is essential for the convenience of users and easy access to requested information.

As a result of the research, the following conclusions can be drawn:

1. Updating information systems and applications, maintaining patches and automating these processes ensures a consistent level of security.
2. Controlling access to information is important, so it is imperative to develop applications and access policies for stored data to reduce unauthorized access or data compromise. Classifying information for limited access is an important step.
3. The use of secure protocols enables end users to secure their home networks and organizations to protect corporate networks. Transmitted data is protected and encrypted.
4. Educating staff and students in the area of information security will reduce IT team effort and increase cyber security through distributed efforts. Determining cyber security at HEI is a complex process due to distributed systems and many challenges, and research in this area is a long way off. COVID-19 has brought about the necessary changes in the institution of studies in higher education, the need to protect new assets.

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Future Scope

Modern video communication technologies allow us to work together face-to-face, in the same place, regardless of our location. These innovations will enable companies, nations, cultures, continents and time zones to expand their workforce and hire talented people from all over the world to solve the world's biggest problems. COVID-19 has prompted all businesses to work remotely in line with the new reality of social distance. When the epidemic is over, people will go back to the office, but we will not go back to the way we worked. Transparency Market Research estimates that by 2027, the market value of video collaborations will reach \$ 11.56 billion, and demand for this technology will continue to grow. The question is how video conferencing will evolve and further change the way we work.

The new era of remote work in the epidemic has shown us how valuable video conferencing is not only to work together remotely, but also to increase the productivity and efficiency of our teams. Diverse teams such as designers, engineers, marketers, product managers, sales and support can expand around the world and still be together in a virtual room, reducing the need for travel to keep everyone on the same page. Companies are no longer limited to local talent as it is possible to recruit talent from around the world through video conferencing. Doing spatial work like Lifelike Avatar is transforming the space around us into virtual meeting rooms so that we can all collaborate together as if we were in the same room.

Pinning ideas and dynamic content to virtual walls and sharing real-time notes in seconds from any device (laptop, phone) are practical examples of living in mixed reality. Digital objects in virtual rooms become physical, so you can scroll through them - pick the images and content you like and toss them on the virtual wall. Anyone can enter and exit these virtual rooms and they can cooperate at any time just like real physical rooms. All of these may be in the concept stages at the moment, but as companies adopt these technologies, the way we work will change forever. With the help of technology, we are breaking the barrier of distance to work together for direct, face-to-face interactions that build commitment and trust and to fulfill our human desires.

Although the tech world in general has been busy developing new features and technologies to improve video conferencing, people have high expectations on multimedia, video and communication technology, which today provide great visual and sound quality to their home theater systems. Experience. It's not 90's, and connecting to the Internet via dial-up can be terrifying. No one has the patience to wait for video buffering or cracking sounds. Without proper video quality and sound management, any video conferencing event can quickly

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disappoint users. The video conferencing application is attractive and will only be accepted by end users when its design provider is at the center of mind while implementing new features.

CHAPTER 6

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